apex; hind femora long with a row of very long, brownish yellow, stout bristles, which are very pale yellow towards apex and the tips bent. This row is located close to the under side of the femur and behind this row are numerous yellow shorter bristles. Hind metatarsus long, slender and only slightly bent.

Length 4.75 mm.

Type Locality.—Lat. 69–10 N, Long. 141 W.
One specimen. Aug. 14–17, 1912. J. M. Jessup, Collector.
Type, male, Cat. No. 22322, United States National Museum.

THE GENITALIA AND TERMINAL ABDOMINAL STRUCTURES OF MALES, AND THE TERMINAL ABDOMINAL STRUCTURES OF THE LARVAE OF "CHALASTOGASTROUS" HYMENOPTERA.

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In a paper published in vol. 27, 1916, p. 303, of the Ent. News, the insects here discussed were classed as a distinct order called the *Prohymenoptera*, or sawfly group—a more inclusive division than MacLeay's "Bomboptera," which, according to Ashmead, 1896, included only the "Uroceridae" (*i. e.*, the Siricidae), the "tenthredinid" sawflies being placed with the Trichoptera, by MacLeay, who restricted the designation "Hymenoptera" to the forms with apodous larvae. Rohwer and Cushman, 1917, would divide the sawfly group into two suborders, the Chalastogastra (Konow, 1897) and the Idiogastra (Oryssidae), but these investigators are unwilling to admit the sawfly group as a distinct order, because they consider that the Idiogastra (*i. e.*, the Oryssidae) are intermediate between the rest of the sawfly group and the higher Hymenoptera called Clistogastra[1] by Konow, 1897. If the existence of intermediate forms, however, were sufficient grounds for "lumping" two related orders into one "homogeneous" order, on exactly the same grounds, we would have to group the Lepidoptera and Trichoptera together as merely one order, since the lepidopterous family Micropterygidae is unquestionably intermediate between the Lepidoptera and the Trichoptera, and has even been removed from the Lepidoptera and placed as a suborder of the Trichoptera by Comstock, 1918, in his recent book on the wing veins of insects! The non-participation of the first abdominal seg-

[1] The division of the Hymenoptera into Symphyta and Apocrita by Gerstaecker, 1867, is exactly the same as Konow's division of the Hymenoptera into Chalastogastra and Clistogastra, which it antedates by thirty years.

ment (propodeum) in the formation of the thorax, the board junction of the thorax and abdomen, the more primitive type of head, wing venation, nature of the termal abdominal structures, etc., are sawfly features which would differentiate this group from the higher Hymenoptera almost as markedly as the Lepidoptera are differentiated from the Trichoptera; but the weight one would give to these differences is largely a matter of personal preference, and for the sake of convenience, the sawfly group has been referred to as a part of the order Hymenoptera, in the following discussion.

Those who have figured the genitalia of male sawflies usually make no attempt to homologize the parts with those of other insects, or even with those of the higher Hymenoptera, and since the workers in related groups such as the Diptera, Lepidoptera, Trichoptera, Hemiptera, etc., use their own special terminology in each group, without regard to other related insects, or the lower forms, it has seemed preferable to attempt to apply to the parts of the genitalia of sawflies, the uniform terminology worked out for the genitalia of lower insects, and the Neuroptera, Mecoptera, Trichoptera, Diptera, etc., in papers by Crampton, 1918_a and 1918_b. In this way, the true significance of the parts is brought out in the sawflies, whereas, to attempt to apply to the parts such meaningless terms as "cardo," "stipes" and "lacinia" (which have always been used for structures of the maxillae) or the term squama (usually employed to designate the proximal calypter at the base of the wing in Diptera, or the scale at the base of the abdomen in ants, etc.) used by some workers to designate the parts of the genitalia of higher Hymenoptera, would be grossly inexact and very misleading. It would be fully as deplorable to use the terms cardo, stipes, etc., for parts of the genitalia, as it would be to employ the terms mentum, submentum, etc., in this connection, since the former terms have always been used for parts of the maxillae, and if anatomical terms in entomology are ever to have any exact meaning at all, as they do in vertebrate anatomy, such ignorant or slovenly usage of terms must be done away with, each term must be applied only to homologous structures throughout the orders of insects.

No attempt has been made in the present paper to trace the modifications of the larval structures through the pupal to the adult stages, since the material requisite for such a study is not at present available—although I am hoping to carry out such a study in the near future. It has seemed advisable, however, to include a brief discussion of certain of the structures present in the larval stages, since some of the interpretations of the parts

by MacGillivray, 1913, would appear to need revising, and a comparison with the structures of lower insects would permit the determining of their homologies with a fair degree of certainty. For the greater part of the material upon which the present study was based, and for many valuable suggestions, I am deeply indebted to the kindness of Mr. S. A. Rohwer, whose generous assistance has made this work possible.

In referring to the different abdominal segments of the male, I would count them in the dorsal region, beginning with the basal abdominal tergum (which is usually demarked into two symmetrical halves), since the sternal region of the first abdominal segment has become lost through atrophy, or through uniting with the hindermost segment of the thorax. The presence of the first abdominal spiracle in the basal segment of the abdomen will serve to differentiate it from the thoracic region, if there is any question as to its identity. For studying the union of the first abdominal segment (propodeum) with the thoracic region, *Cephus* offers an extremely interesting intermediate condition between the lower and higher types of Hymenoptera; but the discussion of this region can be better taken up elsewhere.

In most sawflies, the tergum or "tergite" of the eighth abdominal segment (sometimes referred to as the eighth "dorsal segment") is clearly evident as in Figs. 42, 46, 49, 50, 55, 56, etc., where it is labeled "8^t." In *Oryssus* (Fig. 42) and many other sawflies (Fig. 56) it overlaps the terga of the succeeding segments, and may be referred to as the "*pseudopygidium*." In *Tremex* (Fig. 49), however, the eighth tergum does not overlap the succeeding ones to any great extent. The sternum or sternite of the eighth segment is labeled "8^s" in the above-mentioned figures.

In some sawflies, such as *Hemitaxonus*, etc. (Figs. 50, 56, 57, etc.), the sternum or "sternite" of the eighth segment "8^s" is greatly reduced and becomes so narrow in the mesal region that it is almost divided into two lateral halves. This fact, and the partial overlapping of the eighth sternum by the sternum of the seventh segment, caused Newell, 1918, to disregard the true eighth sternum in her figures of a male sawfly (*Dolerus*) and to designate the true ninth sternum (labeled "ha" in all figures), incorrectly, as the eighth. If one examines a sawfly such as *Tremex* (Fig. 49), however, it is very easy to identify the tergites and sternites, since the eighth sternite "8^s" is large, and the ninth tergite, or *pygidium*, "9^t," which in *Tremex* and most siricids is demarked into two halves by a convolution along the mid-dorsal line, is not overlapped to any great extent by the eighth tergite "8^t"

and is clearly the corresponding dorsal region (tergite) of the ninth sternite "ha."

The sternite "ha" (Figs. 46, 49, 55, 56, etc.), situated below the male genitalia has been referred to as the *hypandrium* in all insects (Crampton, 1918_a and 1918_b), regardless of whether it represents of the sternum of the eighth, ninth, or other abdominal segment. It is incorrectly referred to as the hypopygium in some insects; but this term always refers to the entire male genitalia, etc., in Diptera, or to the plate immediately below the anus (*i. e.*, the ventral plate of the terminal segment labeled "ep" in Fig. 55, etc.) in other insects, so that in order to avoid ambiguity, the more appropriate designation *hypandrium* has been retained in the present paper for the plate labeled "ha," situated below the male genitalia.

The apparent tenth tergite labeled "ep" in Figs. 49, 54, etc., probably represents the united tenth and eleventh tergites of lower insects. It frequently bears the small appendages "c" homologous with the *cerci* (Figs. 46, 54, etc.) and is situated above the anal opening "a" of Figs. 46, 50, 54, etc. The region below the anal opening is sometimes chitinized to form a *subanal plate* or *hypoproct*, while the *supraanal plate* "ep" is referred to as the *epiproct*, in lower insects. In the Mecoptera, the entire region through which the anus "a" opens, including the epiproct "ep" (Fig. 50) and hypoproct, is called the *anal pappilla* or *proctiger*.

The supraanal plate or epiproct "ep" of Fig. 54, tends to unite with the tergite of the ninth segment "9^t;" and in many sawflies, both are overlapped by the eighth abdominal tergum. In *Oryssus* (Fig. 42) not only the ninth and tenth tergites, but the genitalia also are retracted beneath, and are completely concealed by, the tergum of the eighth (and the sternum of the ninth) abdominal segment. Except in a few cases, however, such as that of *Oryssus*, mentioned above, the male genitalia are at least partially visible from the exterior.

The copulatory apparatus of the male, is typically composed of a *basal ring*, "gg" (Figs. 1, 27, 41, etc.) which bears a pair of *genital forceps* or *claspers*, each of whose arms is composed of a *basal segment* "gb" and *distal segment* "eg" (Figs. 27, 41, etc.). A pair of *copulatory ossicles* "gl" becomes differentiated from the basal segments of the forceps "gb" (Figs. 14, 17, 40, etc.), and beside them there usually occurs a larger sclerite "pal" which is also probably a demarked portion of the basal segments of the genital forceps. On the opposite side of the "genitalia" there sometimes occurs a pair of processes "pa" (Figs. 1, 2 3, etc.), which

are usually located rather close to the penis valves "pv." The penis valves "pv" (Figs. 1, 7, 13, 21, 26, 27, etc.) may constitute the true penis, but there is some reason for considering that they form a "pseudopenis" enclosing a delicate structure which represents the true penis. The enclosed delicate structure, however, is so fragile and poorly preserved in the material available for study, that I am unable to determine whether it represents the true penis, or is merely the coagulated seminal fluid—although from its rather constant form in the insects studied, I am inclined to regard it as a definite structure representing the penis of other insects.

In the lower sawflies and siricid group (Figs. 19, 28, 53, etc.) and also in *Xiphidria and Cephus* (Figs. 20 and 21) which are closely related to the siricids, the copulatory ossicles "gl" and the sclerites "pal" are located on that side of the "genitalia" which is ventral when *in situ*, and this very probably represents the original condition of the parts. In certain other sawflies, however, such as *Cimbex* (Fig. 14), *Dolerus* (Fig. 40), etc., the copulatory apparatus as a whole has been turned over (revolving on its long axis) so that the copulatory ossicles "gl" and the sclerites "pal" which were formerly ventrally located, now come to lie on the dorsal surface of the copulatory apparatus when *in situ*. The "twisted" appearance of the membrane and muscles at the base of the "genitalia" frequently gives evidence of this revolution of the copulatory apparatus through 180 degrees (on its long axis), but there is no sign of a "torsion" in the chitinous plates themselves, since the copulatory apparatus *revolves as a whole*, and if one were not prepared to look for such a revolution of the "genitalia" by the analogous condition occurring in some Diptera, etc. (in which there is a similar "inverting" of the parts), it would be rather confusing in attempting to homologize the parts of the "genitalia" in those insects in which such a "torsion" occurs. Thus Newell, 1918, was apparently unaware that there has been such a torsion of the copulatory apparatus in *Dolerus*, and attempts to homologize parts *originally* or *primitively dorsal* in sawflies (and only secondarily ventrally located in *Dolerus* through a revolving of its copulatory apparatus through 180 degrees) with parts which are always *ventral* in *Lepisma*, etc.; and many of the interpretations of the parts, especially in Neuroptera, Mecoptera, sawflies, etc., given by Newell, 1918, are not at all in accord with the conclusions I have reached from an examination of a rather extensive series of these insects, and the lower forms.

In attempting to intepret the parts of the "genitalia" of a saw-

fly, it is a comparatively simple matter to determine the correspondence of the genital forceps of a primitive sawfly such as *Megaxyela* (Fig. 27, "gb" and "eg") with the forceps called *gonopods* (Crampton, 1918_b) in such primitive Mecoptera as *Merope* (Fig. 35, "gb" and "eg"). In some Mecoptera as in the one shown in Fig. 31, the basal segments of the genital forceps "gb" unite to form a basal region bearing the distal segments "eg" of the gonopods, or forceps, and in the same way, in some sawflies, as in the one shown in Fig. 9, the basal segments of the genital forceps "gb" unite to form a basal region bearing the distal segments "eg" of the gonopods or forceps. This interpretation of the parts seems so self-evident, that it is difficult to understand how Newell, 1918, comes to such a different conclusion as to the homologies of the parts, unless the wrong labels were attached to her figures, and her tables of sclerites and appendages were inadvertently placed under the names of the wrong insects in some cases. Thus in her figure of the genitalia of *Dolerus*, Newell would interpret the distal segment of the forceps "eg" of Fig. 39 (of the present paper) as "appendage IV" homologous with the cerci of lower insects, although she correctly figures the cerci of a male *Dolerus* elsewhere. The median plates with their processes "pa" of Fig. 39, Newell would interpret as the homologues of the distal segments of the gonopods "eg" (Fig. 31) of the Mecoptera, while the basal region of the gonopods of the Mecoptera ("gb" of Fig. 31) are homologized with the basal ring "gg" of *Dolerus* (Fig. 39) by Newell, who regards the basal ring "gg" of Fig. 39 as the sternum of the ninth abdominal segment in *Dolerus*, although it probably belongs to the tenth segment instead (the true ninth sternite being the large plate "ha" of all figures), and it comes to have a ventral position in *Dolerus* only secondarily, through a revolution of the copulatory apparatus about its long axis. The homologies proposed by Newell for the Neuroptera, and other forms, are also not in accord with the interpreptation of the parts given in a paper dealing with the gonopods of these insects, Mecoptera, etc. (Crampton, 1918_b), but it is not necessary to take up the discussion of the gonopods of these insects here.

Berlese, 1909, interprets the basal segments of the forceps of *Cimbex* (Figs. 1 and 14, "gb") as the sternite of the tenth abdominal segment, although they are clearly the homologues of the basal segments of the gonopods of lower sawflies (Fig. 27, "gb"), Mecoptera (Figs. 35, 31, "gb"), etc. The distal segments of the forceps (Figs. 1 and 14, "eg"), Berlese calls "stili" in *Cimbex*, and applies the same designation to the styli of ephemerids

(Figs. 29, and 58, "s"). If one compares the unsegmented styli of the ephemerid shown in Fig. 29, "s" with the unsegmented forceps of the sawfly shown in Fig. 8, "eg," there is apparent a strong resemblance between the two, and the basal ring "gg" of the sawfly (Fig. 8) resembles the sternite labeled "ha" in the ephemerid (Fig. 29) quite markedly. This interpretation of the nature of the forceps has much to recommend it. On the other hand, there is a possibility that the so-called parameres[1] of certain lower insects (Figs. 30, 34, etc., "pm") may be the forerunners of the genital forceps.

Tracing the ontogenetic development of the parts from the immature to the adult stages is one method of determining the correct interpretation of the parts; but unfortunately this has not been done in the case of the Hymenoptera. Klapalek, 1903, however, states that the gonopods of adult Trichoptera (Fig. 52, "gb" and "eg") correspond to the hindermost abdominal legs or "postpedes" of the larvae (Fig. 43, "pp"), and if this be true, we have a basis for determining the homologies of the forceps of the Hymenoptera (Fig. 27, "gb" and "eg"), since these structures are homologous with the gonopods of the Mecoptera and Trichoptera (Figs. 35 and 52, "gb" and "eg"), and must therefore also correspond to the postpedes of the larvae (Fig. 43, "pp"). These postpedes or "anal prolegs" do not represent styli (appendages of the basal segment of the leg in Apterygota) but are now considered to represent true abdominal legs by most recent embryologists, so that if the forceps represent "anal prolegs" or postpedes, they can hardly he homologized with the styli of ephemerids (Figs. 29 and 58, "s"). If the genital forceps are

[1] Wheeler, 1910, in his book on ants, designates the entire copulatory apparatus of the male, as the"parameres." Escherich, 1905, following other students of the Apterygota, and Burr, with all modern dermapterists, have used the designation "parameres" to denote the structures labeled "pm" in Figs. 30, 34, etc., and there seems to be no valid reason for attempting to change this widespread and generally accepted usage of the term among the workers on the Apterygota and Dermaptera, especially since the application of the term "parameres" to the entire copulatory apparatus of the male, has been employed by only one or two students of the ants. I suggested using the term phallus for the entire copulatory apparatus, as is done in lower insects; but since there might be some objection to this usage of a term which is made a synonym of the term penis in Smith's "Glossary," I have employed the designations genitalia, genital apparatus, or copulatory apparatus for the parts of the male alone, in the present paper, since we already have the designations ovipositor, sting, etc., for the "genitalia" of the female. The designation "copulatoria" has also been suggested for the entire copulatory apparatus of the male.

modified styli, they might be called gonostyli to indicate their true nature; but for the purpose of this paper, it is sufficiently accurate to designate the forceps of male sawflies as the gonopods, since this term is applied to homologous structures in the nearly related Mecoptera, Trichoptera, Neuroptera, etc.

The penis valves "pv" of Figs. 1, 27, 40, 41, etc, composing the central structure called the "penis," by students of the sawfly group, may possibly represent the paired structures labeled "eu" in Fig. 29 of an ephemerid, or the structures labeled "pm" in Fig. 30, or in Fig. 34, may be homologous with the penis valves. Whatever their homologues in lower insects may be, the penis valves of sawflies ("pv" of Figs. 27, 41, etc.) appear to be homologous with the penis valves of the Mecoptera, labeled "pv" in Figs. 35 and 31, and provisionally, at least, I would adopt this interpretation of these parts. It has been suggested that the penis valves may be homologous with the structure sometimes called the uncus in higher Hymenoptera, but since the penis valves do not form an "uncus," or hook, in the sawflies, and since they do not appear to be homologous with the structure to which the term uncus is usually applied in the Lepidoptera, I prefer to refer to them simply as the penis valves when they are distinct, or as the "penis," when they are united—although a subsequent study of the sawflies may indicate that the true penis is a delicate structure enclosed within the penis valves.

The copulatory ossicles "gl" (Figs. 40, 16, 14, etc.) of sawflies may possibly be homologous with the structures termed "sagittae" (a designation usually applied to the markings of the wings in Lepidoptera) in higher Hymenoptera, and I have therefore provisionally designated them as the "sagittae" in the present paper, although I have not as yet been able to obtain the intermediate forms to enable me to determine whether this is the correct interpretation of these parts, or not; and the same is true of the parts which I have provisionally homologized with the so-called volsellae of higher Hymenoptera (*i. e.*, the sclerite labeled "pal," in the different figures of sawfly genitalia). I had formerly referred to the structures "gl" and "pal" as the "gonossiculi" and "parossiculi;" but rather than to introduce new terms for parts already supplied with appropriate designations, it is preferable to apply the terms sagittae and volsellae to them provissionally, until the necessary material is available to determine whether this interpretation is correct or not. The terms praeputium and manubria have (in a few instances) been applied to the plates and processes labeled "pa" in the different figures of sawfly genitalia; but I prefer to refer to these structures simply as the parapenis plates and processes. The designation prae-

putium has come to have a definite and universally accepted meaning among the dermapterists, who apply this term to that portion of the penis within which the "glans" is retracted, and since the other application of the designation praeputium to the basal segments of the gonopods by a few of the workers on the sawfly group is not recognized as a valid usage in any glossary, textbook, or general work, I prefer to give the term praeputium its general and widely accepted application—namely to restrict its application to the above-mentioned parts of the penes of the Dermaptera, for which it is unusually appropriate. Similarly, the designation "manubrium" cannot be applied to the parapenes "pa" (Fig. 1), as is done by a few students of the sawfly group without creating unnecessary confusion, since the term manubrium has come to have a definitely established and widely accepted application to the base of the spring in Collembola, and any attempt to apply it to other structures, such as the projecting portion of the mesosternum of the Elateridae, or to the adbominal sterna of certain earwigs, etc., should be abandoned if we are ever to have any uniform terminology applicable to all of the orders of insects—as students of wing-venation are attempting to establish.

In a male of the roach *Periplaneta americana* (shown in Fig. 77 of a paper by Crampton, 1918_a), it may be seen that the pair of appendages borne on the plate situated *below* the anus, are the styli, while the cerci are situated *above* the anal opening. Similarly, in the ephemerid shown in Fig. 58 of the present paper, the segmented appendages "s" borne on a plate situated *below* the anal opening are arthrostyles, or segmented styli, while the cerci "c" are situated *above* the anal opening. Since the segmented appendages borne on the plate situated *below* the anal opening "a" of the larva of *Neurotoma* shown in Fig. 44 occupy a situation similar to that of the segemented appendages "s" of the ephemerid shown in Fig. 58, I would homologize the segmented ventral appendages of the *Neurotoma* larva ("s" of Fig. 44) with the arthrostyli or segmented styli "s" of the ephemerid shown in Fig. 58. On the other hand, the small cornicles labeled "c" in Figs. 43 and 47 of the larvae of *Pteronidea* and *Tremex* are located *above* the anal opening "a" and are probably homologous with the cerci "c" of lower insects (Fig. 58, etc.). MacGillivray, 1913, would call both the structures labeled "c" in Figs. 43 and 47, and those labeled "s" in Figs. 44 and 48, "anal cerci." That the two types of structures are not the same may be readily seen by comparing together the larva of *Cephus* and that of *Tremex* (Figs. 47 and 48). In both of these wood-boring larvae, as well as that of *Sirex* and similar forms, there occurs of postcornus

"pc" analogous to, if not actually homologous with, the similar posterior horn of the wood-boring larva of the Coleopteron *Cupes*, etc., although it is not exactly comparable to the caudal horn of the lepidopterous sphingid larvae. Above, and to one side of the post cornus, "pc," of Figs. 47 and 48, is a lateral caudal groove "lg," and above the base of the postcornus is a dorsomedian caudal groove "dg" exactly similar in both larvae; but in *Tremex* (Fig. 47) a pair of cornicles "c" probably homologous with the cerci (although the homologies of similar cornicles of coleopterous larvae with cerci of lower insects have been disputed) is situated near the end of the dorsomedian caudal groove "dg" not far from the base of the postcornus "pc," while in *Cephus* (Fig. 48) these cerci are lacking. On the other hand, the ventral plate "hy" situated below the anal opening "a" of *Cephus* (Fig. 48), bears a pair of appendages labeled "s" which cannot be homologized with the cornicles "c" of the similar larva of *Tremex* (Fig. 47) since they do not occupy the same position in the two larvae with respect to such "landmarks" as the dorsomedian cuadal groove "dg," lateral groove "lg," postcornus "pc," anal opening "a," and ventral region "hy," which are practically the same in both larvae (Figs. 47 and 48). The ventral appendages "s" of the larva of *Cephus* (Fig. 48), however, occupy a similar position with respect to the anal opening "a," ventral region "hy," etc., as the structures "s" of the larva of *Neurotoma* (Fig. 44) do, and there can be little doubt that the structures labeled "s" are homologous in the two larvae shown in Figs. 48 and 44. If the cornicles "c" of the larva shown in Fig. 47 are cerci (the designation "anal" cerci is not necessary, since the term cerci alone sufficiently defines the structures in question), then the structures labeled "s" in Figs. 48 and 44 are not cerci, and it would be incorrect to designate them as such (as is done by MacGillivray, 1913, who calls them all "anal cerci") and the term arthrostyli, or segmented styli should be applied to the appendages "s" of Fig. 44, since they are apparently homologous with the arthrostyli "s" of the ephemerids, etc. (Fig. 58).

The half English, half Latin designation "prolegs" is usually applied to the abdominal limbs of larvae; but if the terms pronotum, procoxae, protarsus, etc., indicate structures of the prothorax, then the term "prolegs" should refer to the legs of the prothorax alone, and in the interest of exact usage the designation uropoda (which according to Smith's "Glossary" refers to the abdominal legs in general) should be applied to the limbs of the urites—as the abdominal segments are commonly called among entomologists. Most recent investigators now admit that the abdominal appendages in question represent the vestiges of true limbs, so that there can be no objection to calling them

uropods, from this standpoint. The terminal abdominal limbs are here referred to as "postpedes," merely for the sake of convenience in order to distinguish them from the other uropods.

The postpedes "pp" of the larvae of *Megaxyela* (Fig. 51) and certain other sawflies, bear a pair of postcalli "pca," or posterior callus-like structures, whose function is unknown. It is possible that the region labeled "pca" in the larva of *Pteronidea* (Fig. 43) may correspond to the united structures "pca" of the *Megaxyela* larva; but I am not certain of this point. The relation of the appendages labeled "s" in Figs. 44 and 48, to the postpedes "pp" of Figs. 43 and 51 (or to the structure "pca" of the latter figures) is largely conjectural; but, since styli occur on the basal segments of the limbs of such forms as *Scolopendrella*, *Machilis*, etc., I hardly think that the styli "s" of larvae (Fig. 44, etc.) represent entire limbs (or their vestiges), but are rather limb *appendages* which have been retained, while the remainder of the limb which bore them has become atrophied or lost. It would be an extremely interesting bit of investigation to trace out the relationship of the larval appendages "pp" and "pca" of Fig. 51, or the appendages "s" of the larvae shown in Figs. 44 and 48, to the genital forceps of the adult male; but I have not the necessary material, to determine which of these types of larval structures form the forceps of the adult male, and must therefore postpone attempting to determine this question until the requisite material is available.

It would be encroaching upon the province of the specialist who has spent a lifetime in the study of a group of insects, to attempt to determine the interrelationships of the different members of his group, so that it is not the purpose of the present paper to speculate upon the interrelationships of the forms here discussed, since the study of the terminal structures alone can furnish but a portion of the evidence necessary for such a study. On the other hand, the study of the terminal structures can contribute its share of the evidences of relationship—which must be drawn from all available sources—and it may be of some interest to briefly call attention to some of the more patent evidences of relationship afforded by a study of the terminal structures.

Rohwer and Cushman, 1917, would place the Oryssidae in a distinct suborder which they call the Idiogastra, and a study of the terminal structures would indicate that the Oryssidae differ markedly from the remainder of the sawfly group, the parts being extremely highly specialized, or modified, in these forms. The genitalia of a male of *Oryssus sayii* are not visible from the exterior (Fig. 42), and the terminal segments are withdrawn into

the cavity formed by the eighth tergite "8^t" and the ninth sternite "ha." Unfortunately, in removing the genitalia from the male *Oryssus* loaned me by Mr. Rohwer, I did not realize the extreme rarity of the males of these insects, and, due to the great difficulty of handling the smooth segments which offer no means of securing a firm hold with the forceps, my mind was so occupied with removing the genitali intact, that I neglected to note which side of the genital apparatus was uppermost when *in situ*. It is a comparatively simple matter to identify that surface primitively uppermost (*i. e.*, not displaced by a torsion of the copulatory apparatus) in other sawflies, by comparing together the surfaces on which the copulatory ossicles ("gl," of all figures) are located; but in the case of *Oryssus* the parts of the genitalia (while suggestive of a relationship to *Cephus*, and also to *Tremex*) are so different from those of other sawflies that it has been impossible to determine their homologies with any degree of accuracy, although if I knew which side of the genital apparatus is uppermost when *in situ*, it would greatly aid in determining the homologies of the parts. The central structure "pv" of Figs. 37 and 38 evidently corresponds to the penis valves of other sawflies ("pv" of all figures); but I am unable to determine whether the structure labeled "eg?" in Fig. 37 represents the copulatory ossicle "gl" of Figs. 26, etc., of other sawflies (which is a strong possibility), or the distal segment of the forceps "eg" of Figs. 13 and 26, or even the region labeled "pal," although I am inclined to interpret the structure in question in the manner indicated by the label. The structure labeled "pal?" in Figs. 37 and 38 may represent the distal segment of the forceps labeled "eg" in other figures, or the structure labeled "pal" in other sawflies; but I am unable to determine which, from the material available to me at present. From the foregoing discussion, it is quite evident that the Oryssidae differ from other sawflies quite markedly in regard to the parts of their genitalia (which, as a rule, do not vary greatly in the sawfly group), as well as in other anatomical details, and the peculiar character of the genitalia and terminal segments of the Oryssidae might therefore be interpreted as lending weight to the view that they constitute a distinct suborder of the sawfly group. The importance one would ascribe to such a small and highly modified group, however, is largely a matter of personal preference. The lack of intermediate forms has made it impossible to determine the closest affinities of the oryssids among the members of the sawfly group, and the genitalia offer no evident indications of a close relationship to any of the forms here studied, although an examination of a wider range of sawflies, may be more productive of results.

With regard to the affinities of the cephids and xiphydriids, Rohwer, 1915, has described a cephid genus *Syntexis*, which combined characters common to the Xiphydriidae and Cephidae, and he considers that the cephids are like the ancestors of the xiphydriids. I have not examined the genitalia of a male of *Syntexis*, to be able to state whether these structures would bear out Rohwer's contention concerning the ancestral nature of the cephid group; but the genitalia and terminal abdominal segments of the cephids which I have been able to examine, would seem to indicate that the Xiphydriidae in general are *less specialized* than the Cephidae I have seen (compare Fig. 7 with Fig. 8), in so far as the copulatory apparatus is concerned; and the shape of the terminal segments of the male, is a little more like that of the primitive Xyelidae and "Lydidae," in the Xiphydriidae (Fig. 46), than in the Cephidae (Fig. 55), although the latter fact does not necessarily imply that the Xiphydriidae are more primitive in this respect.

So far as the terminal abdominal segments are concerned, the great "breadth" (measured along the long axis of the insect's body) of the eighth abdominal sternite "8^s," and the lengthening of the ninth sternite "ha" in *Cephus* (Fig. 55) are characters suggestive of the condition found in the siricids (Fig. 49), as is also true of the non-overlapping of the ninth and tenth tergites by the eighth tergite, in these insects. The lack of cerci in the siricid shown in Fig. 49 would have no bearing in such a comparison, since other siricids, such as *Sirex*, etc., have well developed cerci. The copulatory apparatus of *Xiphydria* (Fig. 20) is quite like that of *Sirex* (Fig. 53) on the primitively ventral side (*i. e.*, on that side which is ventrally located in those insects in which a torsion of the genital apparatus does not occur); but the copulatory apparatus of *Cephus* (Fig. 8) is more like that of *Sirex* (Fig. 45) on the primitively dorsal side (save for the fact that the basal and terminal segments of the forceps have united to form an apparently single segment), and the wide collar-like character of the basal ring "gg" of *Cephus* (Fig. 8) is especially suggestive of the condition occurring in the siricid group (Figs. 45, 36 and 37, "gg"). The terminal structures of the larvae (Figs. 47 and 48) are strikingly similar in the Siricidae, Cephidae, and Xiphydriidae, and it is quite possible that the Cephidae and Xiphydriidae are more closely related to the siricid group than they are to the "tenthredinoid" sawflies. As far as the torsion of the genital apparatus is concerned, the Siricidae, Cephidae, Xiphydriidae (Oryssidae?), Xyelidae, "Lydidae" (Megalodontidae?) etc., appear to belong to the "*Orthandria*," or group in which no torsion occurs, while all of the other forms I have examined

belong to the "*Strophandria*," or sawflies which exhibit a torsion of the genital apparatus. The interpretation of these resemblances, however, depends upon the character of other structures as well as the genitalia, and the condition here mentioned is referred to merely to indicate a line of investigation which might possibly lead to some interesting results in connection with the study of other structures in addition to the terminal ones.

In all of the siricids which I have been able to examine, there are small spine-like projections near the tip of the copulatory ossicles "gl" of Fig. 53. Similar ossicular spines occur on the region labeled "gl" in *Tremex* (Fig. 36), and I would therefore interpret this region as the homologue of the copulatory ossicles (*i. e.*, the region "gl" of Fig. 36), although it is not demarked from the sclerite "pal" (Fig. 36).

The copulatory ossicles "gl" are small in most of the lower sawflies (Figs. 32, 33, 28, etc., and in *Megaxyela* (Fig. 28) they, and the region "pal," have become folded inward, and come to lie on the mesal surface of the base of the forceps "gb," making it very difficult to detect them in this hidden location. This condition may have been due to a shrinking of the parts in the dried specimen of *Megaxyela* which I examined; but since I was able to study only one representative of these rare insects (males of which are extremely scarce), I am unable to state whether this condition would occur in "normal" specimens, or those not shrunken by drying, although I suspect that this infolding would not occur in fresh material.

The processes labeled "pa" in Figs. 1, 2 and 3, and the plates labeled "pa" in Figs. 4 and 5, do not occur in those xyelids, "lydids" (pamphilids), xiphydriids, cephids and siricids I have examined, and appear to be a modification developed in the "twisted genitalia" group alone, although they are not developed in all the members of this group. Even in the comparatively highly modified genitalia of such forms as *Cephus* (Fig. 8) among the "non-torsion" group there is no marked tendency for the basal segments of the forceps "gb" to unite; but in the members of the "torsion group shown in Figs. 10, 12, 13, etc., the basal segments of the forceps "gb" become rather closely approximated, and in such forms as *Perga* (Fig. 9) there is a marked tendency for these basal segments "gb" to unite, and I should be inclined to interpret such a union as representing a rather high degree of specialization—or departure from the primitive condition.

The "gonocondyle" labeled "b" in Figs. 1, 14, 24, etc., appears to be better developed and more elongate in the "torsion" group of sawflies (*i. e.*, those in which a torsion of the copulatory ap-

paratus occurs); but I doubt that this feature will be found to hold good in attempting to differentiate between the two types, if the torsion of the genital apparatus should prove to have any meaning from the standpoint of the study of the interrelationships of the members of the sawfly group or their mating habits. This, and similar question of the affinities of the sawflies can best be taken up by specialists in these groups, or by those having access to a wide range of types, so that the present paper is intended merely to furnish a basis for the more intensive study of the different types of genitalia and terminal structures present in the sawfly group, and to attempt to determine the meaning and homologies of the parts met with in the terminal structures of these insects.

Mr. S. A. Rohwer has made a preliminary study of the genital apparatus of the males of sawflies based largely upon the genitalia of *Tremex*, and he has very kindly permitted me to include in the present paper his table of the parts of the genitalia (for which he has adopted the terminology employed by other workers in this group) in order that the different views as to the homologies of the parts may be here discussed, in an effort to determine the correct interpretation of the parts, and the designations which should be applied to them. Mr. Rohwer's views of the nature of the genital apparatus, which he considers to be made up of three parts, are briefly set forth in the following table:

Third Gonapophyses.....Forcipes (Outer pair of appendages Of the ninth sternite)	Cochlearium (Claspers of authors, aüssere Haltezange of Enslin, 1912)	
	Stipes	
	Cardo	
First Gonapophyses.....Praeputium (Paired appendages of the eighth sternite)	Sagittae of authors, innere Haltezang of Enslin, 1912	Praeputium
		Manubria
Second Gonapophyses.....Penis (Inner pair of appendages of the ninth sternite)		

Mr. Rohwer informs me that Hartig, 1837, applies the term "manubria" to the processes labeled "pa" in Fig. 1; while the basal portion of these processes (*i. e.*, the plates labeled "pa" in Figs. 4, 5, etc.), together with the copulatory ossicles "gl" of Fig. 14, and the sclerites labeled "pal" in Fig. 14, constitute the structures designated as the "praeputium" by Rohwer, 1912 (pp. 215–217). The "third gonapophyses" or "forcipes" mentioned in the table given above, are the gonopods "gb" and "eg" of the

present paper, together with the basal ring "gg," which is the "cardo" mentioned in the table. The "stipes" is the basal segment "gb" of the gonopods, and the "cochlearium" is the distal segment "eg" of the gonopods. The "penis" mentioned in the table as composed of the "second gonapophyses," is represented by the penis valves "pv" of the present paper, and the "first gonapophyses," which constitute the "praeputium" according to Rohwer, are made up of the structures labeled "gl," "pal" and "pa" in the figures of the present paper.

While it is quite possible that the foregoing table may represent the actual meaning and relationships of the parts of the genitalia to one another, I do not find myself entirely in accord with all of the interpretations Mr. Rohwer has given them. The gonopods or forceps may or may not be the appendages of the ninth, or even of the tenth segment; but one can not determine this point with any degree of certainty until the development of these structures has been traced through the larval to the adult stages. Furthermore, I would not interpret the "cardo" or basal ring "gg" (of all figures) as a part of the forceps proper, but rather as a basal plate which bears the forceps, and which may possibly represent the sternal region of the tenth or other abdominal segment, although, as stated above, this question can be best settled by making a study of the ontogenetic development of the parts in question.

The sclerites referred to as the "praeputium" in the table, to my mind are merely detached basal portions of the forceps, and therefore would not belong to part of a segment which does not bear the forceps. As far as the "penis" is concerned, I am inclined to consider that it does not belong to the same segment as that bearing the forceps, since the penis rods ("pr" of all figures) extend forward to the segment in front of the basal ring of the forceps; but here again, I would not care to give any definite opinion on the subject, until the ontogenetic development of the parts in question has been worked out; and reference to the supposed segments to which the different parts of the copulatory apparatus belong has been purposely omitted from the appended table of the parts according to the interpretation here given.

The choice of Hartig's term "praeputium" is, to my mind, a rather unfortunate one, if there is to be any uniformity of application of terms used in the comparative anatomy of all insects, since the designation praeputium has been universally used by students of the earwig or Dermapteron group (*e. g.*, Zacher, and others included in the list of papers dealing with the genitalia of males of Dermaptera given in the bibliography of a paper on the

genitalia of male insects by Crampton, 1918a, page 63) to refer to the structure labeled "eu" in Fig. 34 of the Dermapteron figured in the present paper, and the application of the term praeputium should be restricted to structures homologous with those labeled "eu" in the figure of the Dermapteron (Fig. 34) in all insects. Smith, 1906, (Explanation of Terms Used in Entomology), defines the praeputium as "the external membranous covering of the penis; specifically a spherical muscular mass at the base of the penis in some Orthoptera," and, as so defined, the structures in question cannot be called the praeputium in sawflies, if the term is to have a general application. Similarly, the designation "manubrium" cannot be used for the processes labeled "pa" in Fig. 1, without creating confusion, since the term manubrium is applied to a ventral plate of the abdominal region in Dermaptera, to the anterior projecting portion of the mesosternum of elaterid beetles, and to the base of the spring in Collembola (a usage accepted by most entomologists), thus making it far preferable to use some other term for the structures in question in the sawflies, if we are to avoid confusion in the established application of the term manubrium.

While the designation genital forceps is extremely appropriate for the gonopods, the same term is applied to the forceps-like cerci (which are not homologous with the gonopods) in the Dermaptera, and since the gonopods of sawflies are not homologous with the cerci of Dermaptera, but are possibly homologous with the structures near the penis in these insects, it is preferable to employ the term gonopods for the genital forceps of sawflies, since they clearly correspond to the structures called gonopods in Mecoptera, Trichoptera, Neuroptera, etc.

The term "cochlearium" (which I take to be the Latin word meaning "a spoon"), while very appropriate for the spoon-like or shell-like terminal segment of the gonopods of sawflies, is hardly suitable for the slender, claw-like terminal segment of the gonopods of Mecoptera, etc., which is nothing like a spoon, and since the term harpes has been universally applied to the terminal segments of the gonopods in Lepidoptera, it has seemed preferable to retain the designation harpes for the terminal segments of the gonopods of insects in general. The use of the terms cardo and stipes for the basal ring and the basal segment of the gonopods is greatly to be deplored, since the designations cardo and stipes have always been applied to sclerites of the maxillae, and if we are ever to have a uniform application of terms in entomology (as is insisted upon in vertebrate anatomy), such indescriminate usages must be abandoned. On this account, in place of the designations cardo, stipes (pleural "stipites"), and lacinia as

applied to the parts of the genitalia, I have substituted the designations gonocardo, and gonostipes, and have retained the alternate term volsella (in place of lacinia). It should be borne in mind, however, that the designation "stipes" is usually applied to the *entire* arm of the "outer forceps" (*i. e.*, the gonopods) in higher Hymenoptera, instead of being restricted to the basal segment of the arm of the "outer forceps," as is the case with the designation "gonostipes."

The term sagittae is a very appropriate one for the copulatory ossicles "gl," and I have provisionally adopted this designation for these ossicles, in the present paper, although a subsequent study, with material not at present available to me, may indicate that these ossicles are not homologous with the sagittae of higher Hymenoptera. They were called "gonossiculi" in a former paper. In Mr. Rohwer's table, both the ossicles "gl," and the sclerites "pal" are grouped under the designation sagittae, and Enslin, 1912, in his Fig. 15 of the genitalia of *Sirex*, considers them as merely parts of the "innere Haltezang" (or inner forceps). The two, however, are distinct structures, and I have therefore restricted the designation sagittae to the ossicles "gl" alone, and I have designated the sclerites "pal" (all figures) as the "volsellae," provisionally homologizing them with the parts called volsellae or "laciniae" in higher Hymenoptera, although subsequent investigations may indicate that this interpretation is not entirely correct. The sclerites "pal" were formerly termed the "parossiculi."

The term "penis" has been retained for the structure formed by the penis valves "pv," in the present paper, since this term is applied to the median structure in higher Hymenoptera as well; although I am not certain that what Mr. Rohwer designates as the penis in sawflies is really the penis, or a sheath enclosing the true penis. The material at present available, however, is not sufficiently well preserved to determine whether the delicate structure occurring within the penis valves of many sawflies is a true penis, or merely the coagulated seminal fluid, and until this point has been definitely determined, I have provisionally accepted Mr. Rohwer's interpretation of the structure formed by the penis valves, as the penis.

The following table will serve to briefly summarize the views here expressed regarding the conpositiom of the genital apparatus of male sawflies, and the terms applied to its parts.

Genitalia..... Copulatory or genital apparatus of male sawflies.	Gonocardo, "gg".... or basal ring	Gonocondyle, "b," or basal "condyle."	
	Gonopods, "eg" and "gb"..... claspers, or genital forceps	Harpes, "eg," or distal segments of gonopods.	"Sagittae," "gl," or copulatory ossicles.
		Gonostipes, "gb" or basal segment of gonopods.	"Volsellae," "pal," or copulatory sclerites.
			Parapenes, "Pa." plates of processes on either side of "penis."
	Penisvalvae, "pv," or valves composing "penis."	Penis Rods, "pr"	

The following comparison may be of some aid in interpreting the parts here described, in terms of the table given by Mr. Rohwer:

I Gonopods, "eu" and "gb".....Forcipes (Third gonophyses).
(1) Harpes, "eu".....Cochlearia.
(2) Gonostipes, "gb".....Stipes.
a. Parapenes, "pa".....Praeputium (Manubria).
b. Sagittae, "gl".....Praeputium.
c. Volsellae, "pal".....Praeputium.
II. Gonocardo, "gg".....Cardo.
III. Penisvalvae, or Penis, "pv".....Second gonopophyses, penis.

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ABBREVIATIONS.

a Location of anal opening.
b Process of basal ring (gonocondyle).
c Cerci.
dg Dorsomedian caudal groove.
eg Harpes, or distal segments of the genital forceps, also termed cochlearia.
ep Epiproct, or tergite located above anal opening, regardless of segment it represents, or number of segments composing it.
eu Eupenes, or parts of true penis.
gb Gonostipes, or basal segment of genital forceps (incorrectly called stipes).
gg Gonocardo, or basal ring of copulatory apparatus (incorrectly called cardo).
gl Copulatory ossicles probably homologous with sagittae of higher Hymenoptera.
gm Gonomaculae, or sensory areas.
h Hemitergite.
ha Hypandrium, or sternite located below male genitalia, regardless of segment to which it belongs.
hy Hypoproct, or sternite below anal opening, regardless of segment it represents, or number of primitive segments composing it.
lg Lateral caudal grooves.
mp Median plate.
p Male genitalia, genital or copulatory apparatus ("copulatoria").
pa Parapenes or parapenis plates, also called praeputium and manubria.
pal Probably the volsellae of higher Hymenoptera, (also incorrectly called laciniae).
par Paraprocts, or plates on either side of anus.
pc Postcornus, or caudal horn above anal opening in many wood-boring forms.
pca Postcalli, or Callus-like structures above "anal prolegs."
pm Parameres, or structures on either side of true penis.
po Puppis, or caudal prolongation of hypandrium.
pp Postpedes, or "anal prolegs."

pr Penis rods.
pv Penisvlavae, or penis valves which unite to form the so-called penis.
s Styli, or arthrostyli (segmented styli).
t Telofilum, or median terminal filament.
v Virga, or chitinized terminal portion of ejaculatory duct.

EXPLANATION OF PLATES.

The designation *"ossicular surface,"* refers to that surface of the copulatory apparatus which bears the copulatory ossicles "gl" of all figures. The designation *"abossicular surface,"* refers to that surface of the copulatory apparatus on the side opposite the ossicular surface. The designation *"(primitively) ventral,"* refers to that surface of the genital apparatus which was originally ventrally located in the primitive sawflies, and has remained so in the insect in question. The designation *"(secondarily) ventral"* denotes that surface of the copulatory apparatus which was originally *dorsal* in the primitive sawflies, but, in the insect in question, has come to occupy a ventral position through a revolution of the copulatory apparatus on its long axis, through 180 degrees.

Mr. S. A. Rohwer has identified the specimens and has furnished most of the material used in the preparation of this paper. All figures except those of larvae are of male insects.

Fig. 1. Genitalia of *Cimbex americana*, var. *luctifera*,—Klug, abossicular surface (secondarily ventral).
Fig. 2. Genitalia of *Polyselandria flavipes* (Nort.),—abossicular surface (secondarily), ventral.
Fig. 3. Genitalia of *Pteronidea ventralis* (Say),—abossicular surface (secondarily) ventral?[1]
Fig. 4. Genitalia of *Tenthredella verticalis* (Say),—abossicular surface, (secondarily) ventral.
Fig. 5. Genitalia of *Hemitaxonus dubitatus* (Nort.),—abossicular surface (secondarily) ventral.
Fig. 6. Genitalia of *Cephaleia fascipennis* (Cress.),—abossicular surface primitively) dorsal.
Fig. 7. Genitalia of *Xiphydria mellipes* (Say),—abossicular surface (primitively) dorsal.
Fig. 8. Genitalia of *Cephus cinctus* (Nort.),—abossicular surface (primitively) dorsal.
Fig. 9. Genitalia of *Perga dorsalis* (Leach),—abossicular surface (secondarily) ventral?
Fig. 10. Genitalia of *Eriocampoides amygdalina* (Rohwer) (paratype),—abossicular surface (secondarily), ventral?

[1] The question mark following the designation of the surface of the copulatory apparatus figured, indicates that the genitalia were removed from the insect before it came into my hands, and the designation dorsal or ventral is purely conjectural.

Fig. 11. Genitalia of *Zachizonyx montana* (Cress.),—abossicular surface (secondarily), ventral?

Fig. 12. Gentialia of *Philomastix naucarrowi* (Froggatt),—abossicular surface (secondarily), ventral?

Fig. 13. Genitalia of *Pterygophorus cinctus* (Klug),—abossicular surface secondarily), ventral?

Fig. 14. Genitalia of *Cimbex americana*, var. *luctifera* (Klug),—ossicular surface (secondarily), dorsal.

Fig. 15.[2] Genitalia of *Polyselandria flavipes* (Nort.),—ossicular surface (secondarily), dorsal.

Fig. 16. Genitalia of *Pteronidea ventralis* (Say),—ossicular surface (secondarily), dorsal?

Fig. 17. Genitalia of *Tenthredella verticalis* (Say),—ossicular surface (secondarily) dorsal.

Fig. 18. Genitalia of *Hemitaxonus dubitatus* (Nort.),—ossicular surface (secondarily) dorsal.

Fig. 19. Genitalia of *Cephaleia fascipennis* (Cress.),—ossicular surface (primitively) ventral.

Fig. 20. Genitalia of *Xiphydria mellipes* (Say),—ossicular surface (primitively) ventral.

Fig. 21. Genitilia of *Cephus cinctus* (Nort.),—ossicular surface (primitively) ventral.

Fig. 22. Genitalia of *Perga dorsalis* (Leach),—ossicular surface (secondarily) dorsal.

Fig 23. Genitalia of *Eriocampoides amygdalina*, Rohwer (paratype)—ossicular surface (secondarily), dorsal?

Fig. 24. Genitalia of *Zachizonyx montana* (Cress.),—ossicular surface, (secdarily) dorsal?

Fig. 25. Genitalia of *Philomastix naucarrowi* (Froggatt),—ossicular surface, (secondarily) dorsal?

Fig. 26. Genitalia of *Pterygophorus cinctus* (Klug),—ossicular surface, (secdarily) dorsal?

Fig. 27. Genitalia of *Megaxyela aenea* (Nort.),—abossicular surface, (primitively) dorsal.

Fig. 28. Genitalia of *Megaxyela aenea* (Nort.),—ossicular surface, (primitively) ventral.

Fig. 29. Styli and genitalia of ephemerid *Blasturus cupidus*, male, ventral view.

Fig. 30. Parameres and penis of apterygotan (*Machilis polypoda*, male, ventral view (after Crampton, 1918a).

Fig. 31. Terminal segments and gonopods of Mecopteron *Nannochorista dipteroides*, male, dorsal view (from Crampton, 1918b, after Tillyard).

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[2] The upper right hand label "pa" in Fig. 15 should read "pal."

Fig. 32. Genitalia of *Cephaleia frontalis* (Westw.),—ossicular surface (primitively) ventral.
Fig. 33. Genitalia of *Pamphilius persicus* (MacG.),—ossicular surface (primitively) ventral?
Fig. 34. Genitalia of Dermapteron (Euplexopteron) *Echinosoma occidentale*, ventral view.
Fig. 35. Terminal segments and gonopods of Mecopteron *Merope tuber*, male, dorsal view (after Crampton, 1918b).
Fig. 36. Genitalia of *Tremex columba* (Linn.),—ossicular surface, (primitively) ventral.
Fig. 37. Genitalia of *Oryssus sayii* (Westw.),—abossicular surface? (primitively) dorsal?
Fig. 38. Genitalia of *Oryssus sayii* (Westw.),—ossicular surface? (primitively) ventral?
Fig. 39. Genitalia of *Dolerus collaris* (Say),—abossicular surface, (secondarily) ventral.
Fig. 40. Genitalia of *Dolerus collaris* (Say),—ossicular surface, (secondarily) dorsal.
Fig. 41. Genitalia of *Tremex columba* (Linn.),—abossicular surface, (primitively) dorsal.
Fig. 42. Terminal structures of *Oryssus sayii* (Westw.), male, lateral view.
Fig. 43. Terminal structures of larva of *Pteronidea*, lateral view.
Fig. 44. Terminal structures of larva of *Neurotoma*, lateral view.
Fig. 45. Genitalia of *Sirex edwardsii*—abossicular surface (primitively) dorsal.
Fig. 46. Terminal structures of *Xiphydria mellipes* (Say), male, lateral view.
Fig. 47. Terminal structures of larva of *Tremex columba* (Linn.), lateral view.
Fig. 48. Terminal structures of larva of *Cephus*, lateral view.
Fig. 49. Terminal structures of *Tremex columba* (Linn.), male, lateral view.
Fig. 50. Terminal structures of *Hemitaxonus dubitatus* (Nort.), male, lateral view.
Fig. 51. Terminal structures of larva of *Megaxyela*, lateral view.
Fig. 52. Terminal structures of Trichopteron *Philopotamus* sp., male, lateral view.
Fig. 53. Genitalia of *Sirex edwardsii*—ossicular surface (primitively) ventral.
Fig. 54. Terminal segments, dorsal view, *Xiphidria mellipes*, Say.
Fig. 55. Terminal structures of *Cephus cinctus* (Nort.), male, lateral view.
Fig. 56. Terminal structures of *Megaxyela aenea* (Nort.), male, lateral view.
Fig. 57. Terminal ventral segments of *Megaxyela aenea* (Nort.), male.
Fig. 58. Terminal structures of ephemerid *Heptagenia interpunctata*, male, lateral view (after Crampton, 1918a).